A New Species of *Sciaphila* (Triuridaceae) from Hainan Island, China

Han Xu

Research Institute of Tropical Forestry, Chinese Academy of Forestry, Longdong, Guangzhou 510520, People's Republic of China; Research Institute of Forest Ecology, Environment, and Protection, Chinese Academy of Forestry, Beijing 100091, People's Republic of China.
hanxu81@gmail.com

Yi-De Li

Research Institute of Tropical Forestry, Chinese Academy of Forestry, Longdong, Guangzhou 510520, People's Republic of China

Huan-Qiang Chen

Jianfengling National Nature Reserve, Jianfengling, Ledong 572542, People's Republic of China

ABSTRACT. *Sciaphila jianfenglingensis* Han Xu, Y. D. Li & H. Q. Chen (Triuridaceae) is described and illustrated as a new species endemic to Hainan Island, China. It differs from the closely related *S. arfakiana* Becc. by its longer leaves to ca. 2 mm (vs. ca. 1 mm in *S. arfakiana*), shorter fruiting pedicels 3–6 mm (vs. typically 7–9 mm), three stamens (vs. two or three), 2-celled anthers (vs. 4-celled), and a filiform style (vs. awl-shaped) that far exceeds the ovary.

Key words: China, Hainan, IUCN Red List, *Sciaphila*, Triuridaceae.

The monocot family Triuridaceae consists of either six genera (Meerendonk, 1984) or nine genera (Maas-van de Kamer & Weustenfeld, 1998), with about 50 species distributed throughout the Old World and New World tropics (Meerendonk, 1984; Maas & Rübsamen, 1986; Mabberley, 2008; Guo & Cheek, 2010).

Sciaphila Blume is the largest genus in the family, with ca. 35 species. Hsieh et al. (2003) characterized the genus by the following features: small, achlorophyllous, mycotrophic herbs that are monoecious, with erect stems and scalelike leaves; terminal or racemose inflorescences, with male flowers acropetal; and actinomorphic flowers, with (four to) six (to 10) perianth segments basally connate. The male flowers have two to six stamens, with 1- to 4-celled anthers that are 2- to 4-lobed and dehisce extrorsely; female flowers consist of ca. 10 to 80 ovaries, each with a single ovule, with the filiform style usually exceeding the ovary; bisexual flowers have from three to six persistent stamens, with 1-celled anthers and ca. 10 to 50 ovaries. The fruit is an obovoid follicle, with a persistent style and a single seed with copious endosperm.

Individuals of *Sciaphila* are usually small in size and are not easily discerned in the field. Only five species of *Sciaphila* have been recorded from southern China and Taiwan (Zhou & Zhong, 1992; Wu et al., 2000; Ye, 2003; Hsieh et al., 2003; Zhuang et al., 2004; Guo & Cheek, 2010): *S. arfakiana* Becc., *S. maculata* Miers, *S. ramosa* Fukuy. & T. Suzuki (in Hong Kong and Taiwan), *S. secundiflora* Thwaites ex Benth. (in Guangdong, Hong Kong, and Taiwan), and *S. tenella* Blume (in Guangdong and Hainan). Recent botanical exploration in Hainan Island by the authors has revealed a new species, which is described here.

Sciaphila jianfenglingensis Han Xu, Y. D. Li & H. Q. Chen, sp. nov. TYPE: China. Hainan: Jianfengling Natl. Nature Reserve, under tropical rain forest, 18°44′N, 108°53′E, 810 m, 12 Aug. 2007, *Han Xu & H. Q. Chen JFL00891* (holotype, CANT). Figure 1.

Species *Sciaphilae arfakianae* Becc. similis, sed ab ea foliis longioribus ca. 2 mm longis, pedicellis fructiferis plerumque brevioribus 3–6 mm longis, antheris bilocularis et stylo filiformi 0.7–1.5 mm longo ovarium multo excedente differt.

Saprophytic, monoecious herbs, reddish purple, glabrous; stems erect, slender, with 1 or 2 branches ca. 8–11 cm, 0.3–0.5 mm diam. Leaves alternate, scalelike, acuminate, ca. 2 mm. Inflorescence terminal, racemose, erect, ca. 5–6 cm, with 18 to 48 flowers. Flowers unisexual, with acropetal male flowers; pedicels 3–6 mm, 0.1–0.2 mm diam., straight; bracts lanceolate, 1.2–2.1 mm; tepals 6,

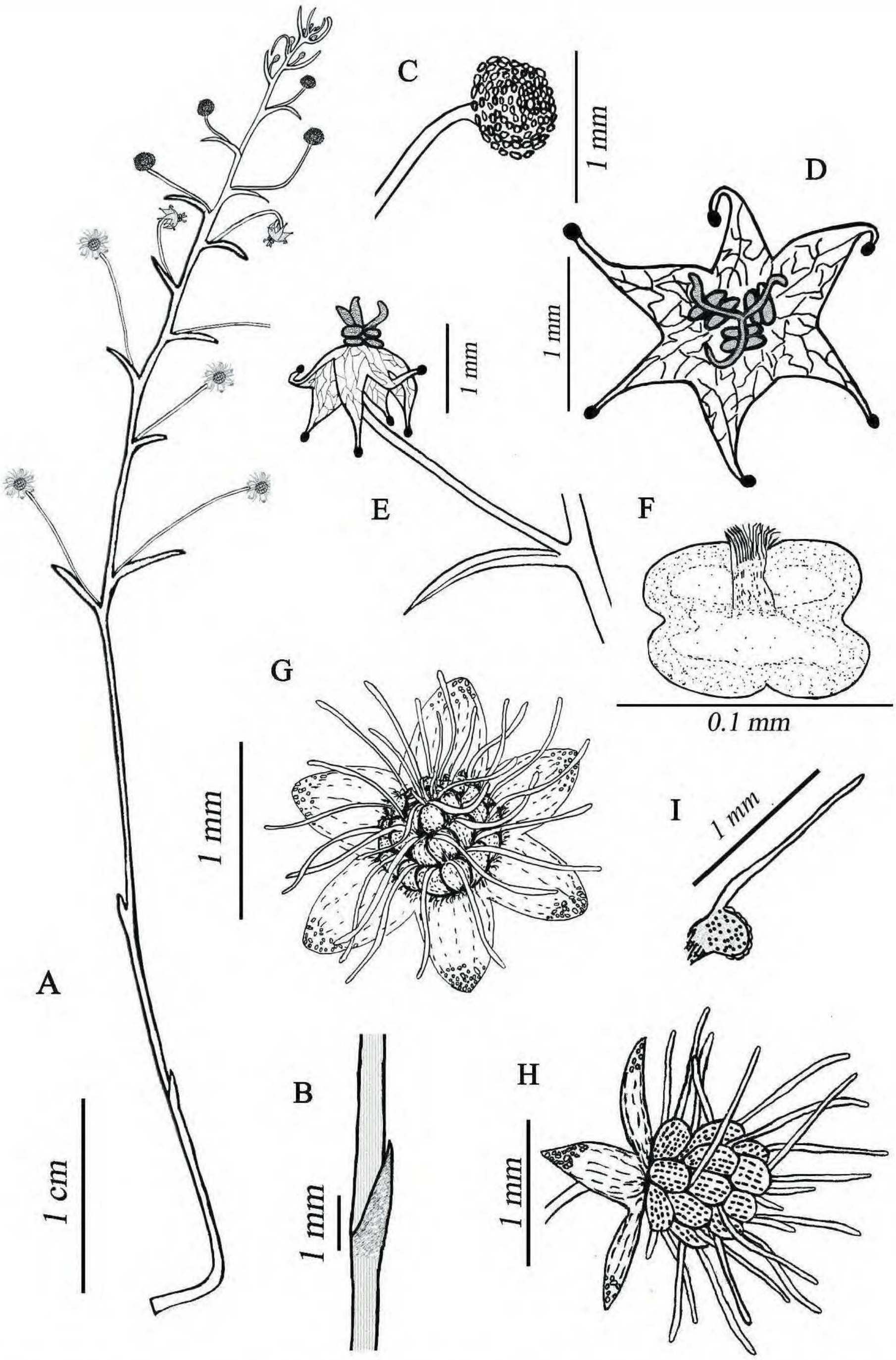

Figure 1. *Sciaphila jianfenglingensis* Han Xu, Y. D. Li & H. Q. Chen. —A. Single fertile individual. —B. Scalelike leaf. —C. Immature flower. —D. Male flower from above. —E. Male flower with bract at base of pedicel. —F. Two-celled anther. —G. Female flower from above. —H. Female flower, lateral view. —I. Ovary with laterally adnate and filiform style. Drawn by S. L. Lu from holotype *Han Xu & H. Q. Chen JFL00891* (CANT).

Table 1. Differences between *Sciaphila jianfenglingensis* and the other five *Sciaphila* species from China.*

	S. arfakiana	*S. jianfenglingensis*	*S. maculata*	*S. ramosa*	*S. secundiflora*	*S. tenella*
Plant size	6–12 cm tall; stems 0.3–0.5 mm diam.	8–11 cm tall; stems 0.3–0.5 mm diam.	10 cm tall; stems 0.6–1 mm diam.	8–12 cm tall; stems 0.3–0.5 mm diam.	4–12 cm tall; stems 0.7–1 mm diam.	7–18 cm tall; stems 0.3–0.5 mm diam.
Leaf length	ca. 1 mm	ca. 2 mm	ca. 1.2 mm	0.8–1.3 mm	2–3 mm	ca. 2 mm
Inflorescence, no. of flowers	5 to 30	18 to 48	ca. 30	3 to 7	3 to 9	ca. 4
Bisexual flower	absent	absent	present	absent	absent	present or male
Diameter, male flower	2.5–3 mm	2–2.4 mm	ca. 2 mm	ca. 2 mm	6–7 mm	ca. 2.5 mm
Stamen number	2 or 3	3	3	2 or 3	2 or 3	6
Anther sac	4-celled	2-celled	3-celled	4-celled	4-celled	3-celled
Style	awl-shaped	filiform	club-shaped	awl-shaped	club-shaped	paintbrush-shaped
Style length	ca. 1 mm	0.7–1.5 mm	ca. 0.2 mm	0.5–0.6 mm	0.6–0.7 mm	< 0.5 mm
Fruiting pedicel	(4–)7–9 mm	3–6 mm	2–2.5 mm	(1.4–)2–3.5 mm	1–2 mm	4–6 mm
Fruit diameter	ca. 2 mm	unseen	ca. 2 mm	ca. 2 mm	ca. 4 mm	1.5–2 mm

* Information for *S. arfakiana*, *S. maculata*, *S. ramosa*, and *S. secundiflora* taken from Hsieh et al. (2003).

basally connate, reflexed after anthesis. Male flowers with the tepals equal, ovate, acuminate, glabrous, ca. 0.8–1 mm, tepal apex with a stipulate, globose knob, ca. 0.1 mm; stamens 3, the anthers 2-celled, ca. 0.08 × 0.06 mm, filaments attached above the receptacle, separate, ca. 0.6 mm; dehiscence introrse and longitudinal. Female flowers with the tepals equal, ovate, glabrous, ca. 0.8–1 mm, with small granular appendages toward the acute apex; ovaries ca. 30 to 40 per flower, ca. 0.15–0.25 mm, with papillate granules, each ovary with 1 ovule; style lateral, 0.7–1.5 mm, adnate to the ovary, filiform, far exceeding the ovary. Fruits not seen.

Distribution and habitat. Only one population of *Sciaphila jianfenglingensis* was found under the canopy of tropical rainforest of Jianfengling National Nature Reserve on Hainan Island, China. This site experiences a tropical monsoon climate and the vegetation is dominated by individuals of Lauraceae, Rubiaceae, Fagaceae, Palmaceae, and Myrtaceae.

IUCN Red List category. Hainan Island is characterized by a high level of endemism. The endemic flora of Hainan comprises 397 species of seed plants in 213 genera and 74 families (Francisco-Ortega et al., 2010). Only a single population with ca. 30 individuals exists at the type locality, but it is likely that other populations exist at other localities. Therefore, *Sciaphila jianfenglingensis* is assigned a preliminary status of Vulnerable (VU D2) according to IUCN Red List criteria (IUCN, 2001), which indicated that it is a population with a very restricted area of occupancy (typically less than 20 km^2) or number of locations (typically five or fewer).

Phenology. Flowering specimens of *Sciaphila jianfenglingensis* were collected in August.

Etymology. The specific epithet is derived from the Chinese pinyin name of the collection locality of the holotype.

Taxonomic relationships. Sciaphila jianfenglingensis is easily distinguished from all other species of *Sciaphila* by its lanceolate fertile bracts ca. 1.2–2.1 mm, the three stamens with 2-celled anthers, and the filiform style 0.7–1.5 mm that far exceeds the ovary. Moreover, the anthers of *S. jianfenglingensis* dehisce introrsely, while those of other *Sciaphila* species dehisce extrorsely. The new species is most similar to *S. arfakiana* in having slender, reddish stems that are glabrous and sparsely branched, as well as the scalelike leaves, six tepals, and papillate ovaries. The new taxon differs by having longer leaves (to 2 mm vs. 1 mm), shorter pedicels (3–6 mm vs. typically 7–9 mm), 2-celled anthers (vs. 4-celled), and a filiform

style 0.7–1.5 mm long that far exceeds the ovary (vs. an awl-shaped style only to 1 mm in *S. arfakiana*).

Six species of *Sciaphila* are now recorded from China (cf. Table 1), with only *S. tenella* also found on Hainan Island. All these taxa are tiny and inconspicuous in the field. *Sciaphila jianfenglingensis* must be considered a rare taxon and endemic to China. The type population is small and is protected in the Jianfengling National Nature Reserve. Further study on its biology, metabolism, and ecology would contribute to our understanding of these saprophytes.

KEY FOR *SCIAPHILA* SPECIES IN CHINA

1a. Styles club-shaped or paintbrush-shaped; stems 0.6–1 mm diam.
  2a. Inflorescence ca. 30-flowered ..... *S. maculata*
  2b. Inflorescence 3- to 9-flowered.
    3a. Tepals barbate at apex ..... *S. tenella*
    3b. Tepals glabrous at apex ..... *S. secundiflora*
1b. Styles awl-shaped or filiform; stems 0.3–0.5 mm diam.
  4a. Styles short, ca. 0.5–0.6 mm ..... *S. ramosa*
  4b. Styles 0.7 mm or more in length.
    5a. Leaves ca. 1 mm long; fruiting pedicels typically 7–9 mm long; styles ca. 1 mm, awl-shaped; anther sacs 4-celled ..... *S. arfakiana*
    5b. Leaves ca. 2 mm long; fruiting pedicels 3–6 mm long; styles ca. 0.7–1.5 mm, filiform; anther sacs 2-celled ..... *S. jianfenglingensis*

Paratype. CHINA. **Hainan:** Jianfengling National Nature Reserve, under tropical rain forest, 18°44′N, 108°53′E, 810 m, 12 Aug. 2007, *Han Xu & H. Q. Chen JFL00892* (IBSC).

Acknowledgments. Fieldwork was supported by Jianfengling National Nature Reserve. The authors are very grateful to Xueying Zhuang, Suqin Fang, Haijun Yang, and Hao Zhang from South China Agricultural University for technical support. This paper was supported by grants from the following agencies: Ministry of Finance of the People's Republic of China (RITFYWZX200902) and Ministry of Science and Technology of the People's Republic of China (2006FY110500).

Literature Cited

Francisco-Ortega, J., Z. S. Wang, F. G. Wang, F. W. Xing, H. Liu, H. Xu, W. X. Xu, Y. B. Luo, X. Q. Song, S. Gale, D. E. Boufford, M. Maunder & S. Q. An. 2010. Seed plant endemism on Hainan Island: A framework for conservation actions. Bot. Rev. 76: 346–376.

Guo, Y. H. & M. Cheek. 2010. Triuridaceae. Pp. 125–126 *in* Z. Y. Wu, P. Raven & D. Y. Hong (editors), Flora of China, Vol. 23 (Acoraceae through Cyperaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis.

Hsieh, T. H., C. S. Wu & K. C. Yang. 2003. Revision of *Sciaphila* (Triuridaceae) in Taiwan. Taiwania 48(4): 239–247.

IUCN. 2001. IUCN Red List Categories and Criteria, Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.

Maas, P. J. M. & T. Rübsamen. 1986. Triuridaceae. Pp. 1–55 *in* Flora Neotropica, ser. I, Vol. 40. New York Botanical Garden, Bronx.

Maas-van de Kamer, H. & T. Weustenfeld. 1998. *Sciaphila*. Pp. 452–458 *in* K. Kubitzki (editor), The Families and Genera of Vascular Plants, Vol. 3. Springer-Verlag, Berlin.

Mabberley, D. J. 2008. *Sciaphila*. Pp. 781, 876 *in* Mabberley's Plant Book: A Portable Dictionary of Plants, Their Classification and Uses, 3rd ed. Cambridge University Press, Cambridge.

Meerendonk, J. P. M. van de. 1984. Triuridaceae. Pp. 109–121 *in* Flora Malesiana, ser. 1, Vol. 10. Erven P. Noordhoff, Groningen, The Netherlands.

Wu, T. L., Z. X. Li & Y. W. Lam. 2000. Triuridaceae—A new record of the family from mainland of China. J. Trop. Subtrop. Bot. 8(2): 157–158.

Ye, H. G. 2003. *Sciaphila*. P. 438 *in* T. L. Wu (editor), Flora of Guangdong, Vol. 5. Guangdong Science and Technology Press, Guangzhou.

Zhou, L. Y. & X. W. Zhong. 1992. *Sciaphila*. Pp. 190–193 *in* S. C. Sun (editor), Flora Reipublicae Popularis Sinicae, Vol. 8. Science Press, Beijing.

Zhuang, X. Y., Y. S. Peng & H. Zhang. 2004. Triuridaceae—A new record of the family from Guangdong province, China. J. S. China Agric. Univ. 25(1): 124.